CLAIMS

1. A data processing apparatus comprising:

an encoder that encodes input digital data on a frame-by-frame basis and outputs resultant encoded data, each frame of digital data including a predetermined number N of samples; and

a decoder that decodes the encoded data,

wherein the encoder comprises

oversampling means that, when the oversampling means acquires N/R samples of data, performs R-times oversampling on the acquired N/R samples of data thereby producing N samples of data;

encoding means for performing encoding on the data on a frame-by-frame basis and outputting resultant encoded data; and

encoding control means that controls the encoding means so as to perform the encoding process at a rate R times higher than a rate at which the encoding process is performed if the encoding is performed after waiting for acquiring N samples of data without performing oversampling,

and the decoder comprises

decoding means for decoding the encoded data; and

decimation means that decimates output data that is output from the decoding means and outputs resultant data including samples the number of which is 1/R time the number of

samples included in the original output data (thereby achieving an algorithm delay that is 1/R times an algorithm delay that would occur in a conventional non-oversampling encoding technique).

2. An encoder that encodes digital data and outputs resultant encoded data, comprising:

oversampling means that performs R-times oversampling on a series of the data;

encoding means that encodes the oversampled data on a frame-by-frame basis and outputs resultant encoded data, each frame of oversampled data including a predetermined number N of samples; and

encoding control means that controls the encoding means so as to perform the encoding process at a rate R times higher than a rate at which the encoding process is performed if the encoding is performed after waiting for acquiring N samples of data without performing oversampling.

3. An encoder according to Claim 2, wherein the oversampling means calculates the sample value of a sample to be interpolated and interpolates the sample with the calculated sample value thereby performing the oversampling.

4. An encoder according to Claim 2, wherein the oversampling means interpolates a sample with a value of zero without calculating the sample value, thereby performing the oversampling.

5. An encoder according to Claim 2, further comprising frequency band division means for dividing the oversampled data into a plurality of subband data, that is, into a plurality of data of frequency bands, wherein

the encoding means includes as many subband data processing means as there are frequency bands, for processing subband data of the respective frequency bands; and

of the plurality of subband data processing means, only subband data processing means responsible for processing subband data of frequency bands in the range from 0 to $\pi/(2R)$ in angular frequency perform the encoding processing but the other subband data processing means do not perform the encoding processing.

6. An encoder according to Claim 2, wherein the encoding means processes only frequency components of the oversampled data in the range from 0 to $\pi/(2R)$ in angular frequency.

7. An encoding method of encoding digital data and outputting resultant encoded data, comprising the steps of:

performing R-times oversampling on a series of the data;

encoding the oversampled data on a frame-by-frame basis and outputting resultant encoded data, each frame of oversampled data including a predetermined number N of samples; and

controlling the encoding step so as to perform the encoding process at a rate R times higher than a rate at which the encoding process is performed if the encoding is performed after waiting for acquiring N samples of data without performing oversampling.

8. A program for causing a computer to perform a process of encoding digital data and outputting resultant encoded data, the process comprising the steps of:

performing R-times oversampling on a series of the data;

encoding the oversampled data on a frame-by-frame basis and outputting resultant encoded data, each frame of oversampled data including a predetermined number N of samples; and

controlling the encoding step so as to perform the encoding process at a rate R times higher than a rate at which the encoding process is performed if the encoding is performed after waiting for acquiring N samples of data without performing oversampling.

9. A decoder that decodes digital encoded data,

the encoded data being obtained by

performing R-times oversampling on a series of the data, and

encoding the oversampled data on a frame-by-frame basis, each frame of oversampled data including a predetermined

number N of samples,

the decoder comprising: decoding means for decoding the encoded data;

decimation means that decimates output data that is decoded on a frame-by-frame basis and output by the decoding means and outputs resultant data including samples the number of which is 1/R time the number of samples included in the original output data; and

decoding control means that controls the decoding means such that the decoding means performs the process at a rate R times higher than the rate at which the process is performed if the decimation is not performed.

10. A decoder according to Claim 9, wherein:

the encoded data is obtained by

dividing data obtained by the R-times oversampling into a plurality of subband data, that is, into a plurality of data of frequency bands, and

performing the encoding process on the subband data of the respective frequency bands;

the decoding means includes as many subband data processing means as there are frequency bands, for processing subband data of the respective frequency bands; and

of the plurality of subband data processing means, only subband data processing means responsible for processing

subband data of frequency bands in the range from 0 to $\pi/(2R)$ in angular frequency perform the decoding processing but the other subband data processing means do not perform the decoding processing.

11. A decoder according to Claim 9, wherein the decoding means processes only frequency components of the encoded data in the range from 0 to $\pi/(2R)$ in angular frequency.

12. A decoding method of decoding digital encoded data, the encoded data being obtained by performing, on a frame-by-frame basis, an encoding process on data obtained by performing R-times oversampling, each frame including a predetermined number of samples, the method comprising the steps of:

decoding the encoded data;

decimating output data that is decoded on a frame-by-frame basis and output in the decoding step and outputting resultant data including samples the number of which is 1/R time the number of samples included in the original output data; and

controlling the decoding step such that the process is performed at a rate R times higher than the rate at which the process is performed if the decimation is not performed.

13. A program for causing a computer to perform a process of decoding digital encoded data, the process comprising the

steps of:

the encoded data being obtained by performing, on a frame-by-frame basis, an encoding process on data obtained by performing R-times oversampling on a series of data, each frame including a predetermined number of samples, the process comprising the steps of:

decoding the encoded data;

decimating output data that is decoded on a frame-by-frame basis and output in the decoding step and outputting resultant data including samples the number of which is 1/R time the number of samples included in the original output data; and

controlling the decoding step such that the process is performed at a rate R times higher than the rate at which the process is performed if the decimation is not performed.